

Phalloplasty: A Valuable Treatment for Males with Penile Insufficiency

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OBJECTIVES	To apply a phalloplasty technique used in female-to-male transsexual surgery in male patients with penile insufficiency.
METHODS	Seven male patients (aged 15 to 42 years) were treated with phalloplasty (6 with radial forearm free flap and one with anterolateral thigh flap) between March 2004 and April 2006 (follow-up, 9 to 34 months). All patients suffered psychologically from their condition, with low self-esteem and sexual and relational dysfunction. They were evaluated by a sexologist-psychiatrist before and after surgery. Erectile implant surgery is offered approximately 1 year after the phallic reconstruction.
RESULTS	There were no complications concerning the flap. Two complications were reported in the early postoperative period. Two patients developed urinary complications (stricture and/or fistula). Patient satisfaction after surgery was high in 6 cases and moderate in 1 case. Psychological evaluation confirms this, especially on the self-esteem level. Four patients underwent erectile implant surgery. In 2 patients the erectile implant had to be removed.
CONCLUSIONS	This success has convinced us that phalloplasty is a valuable treatment for penile insufficiency. It has good results in terms of patient self-esteem and sexual well-being. This technique opens new horizons for the treatment of penile agenesis, micropenis, crippled penis, shrivelled penis, some disorders of sexual development, traumatic amputations, and cloacal exstrophy. UROLOGY 71: 272–277, 2008. © 2008 Elsevier Inc.

Male patients with penile insufficiency still remain a major challenge to the reconstructive urologist. It is a rare condition, and in the literature only case reports and small series are described.^{1–5}

Penile insufficiency or absence has a dramatic negative impact on sexual and psychological well-being.

Surgical reconstruction of the penis (phalloplasty) is difficult because of the different cosmetic (aesthetic phallus, acceptable scar of donor area) and functional (micturition, sexual activity) requirements.

Many of these objectives could not be obtained with the older methods, whereby phallic reconstruction required complex, multistaged procedures. Fortunately, the history of phalloplasty procedures has paralleled the progressions made in plastic surgery. Today microvascular free-flap techniques come closer to fulfilling the above-mentioned requirements. Despite the multitude of free flaps that have been reported, the radial forearm free flap

is universally considered as the gold standard in phalloplasty.^{6–9}

After having gained experience with phalloplasty in female-to-male transsexual surgery, we started to use this technique for penile insufficiency.

MATERIAL AND METHODS

We retrospectively analyzed a cohort of 7 male patients (aged 15 to 42 years) who underwent phalloplasty at our institution between March 2004 and April 2006 (mean follow-up, 20 months) (Table 1).

All patients lost most of their functional penile tissues. In 3 patients this was due to former surgeries for bladder exstrophy. These patients empty their bladder by catheterization through an appendicovesicostomy. One patient wanted a urethral reconstruction for ejaculation; the other 2 preferred to keep their ejaculatory opening where it was (at the ventral aspect of the scrotum). One boy had a crippled penis after several corrective surgeries for hypospadias. One patient had a shrivelled penis after repeated implantation of penile stiffeners, which consecutively were infected and had to be explanted. He suffered from impotence after a pelvic fracture. The last 2 patients underwent penile amputation: the first patient's penis had to be amputated because of an epithelioid sarcoma. The other patient lost his penis because of penile necrosis due to vascular damage after a traffic accident.

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Table 1. Patient characteristics

Patient	Indications	Type of Phalloplasty	Age (yr)	Follow-Up (mo)	Penile Prosthesis
1	Shrivelled penis–infected penile stiffener	Anterolateral thigh flap	42	26	AMS Ambicor, 2 cylinders
2	Shrivelled penis–bladder exstrophy	Radial forearm free flap	23	34	AMS Ambicor, 2 cylinders
3	Shrivelled penis–bladder exstrophy	Radial forearm free flap	16	28	AMS Ambicor, 2 cylinders
4	Penile amputation–epitheloid sarcoma	Radial forearm free flap	15	11	No
5	Crippled penis–hypospadias	Radial forearm free flap	20	11	No
6	Shrivelled penis–bladder exstrophy	Radial forearm free flap	15	9	No
7	Penile necrosis–traffic accident	Radial forearm free flap	32	24	AMS Ambicor, 2 cylinders

AMS = American Medical Systems.

They were all evaluated by a sexologist-psychiatrist with a questionnaire. All patients suffered psychologically from this condition, with low self-esteem and with sexual and relational dysfunction.

After long discussions with the patients and after they were given the opportunity to speak with transsexuals who had undergone the procedure, all patients decided in favor of phalloplasty. In 6 cases a radial forearm free flap was used (our technique of first choice). One patient preferred an anterolateral thigh flap because he wanted to avoid the scar at the forearm. Special consideration was given to the incorporation of any remaining sensitive penile tissue into the neophallus. All patients had some cavernosal tissue left in the depth, and in 4 patients there was even glandular tissue that could be used. This glandular tissue was incorporated at the base of the neophallus.

The nerves of the flap were connected to the dorsal penile nerve for erogenous sensation and the other (nerve of the flap) to the ilioinguinal nerve for tactile and protective sensation. A small skin flap and skin graft are used to create a corona and to imitate the glans. Tattooing of the glans to give it a more natural appearance is usually performed after a 2 to 3-month period, before sensation has returned to the penis. The defect on the forearm was covered with a split-thickness skin graft harvested from the thigh. The urethra inside the neophallus is created by a tube-in-a-tube technique and is anastomosed to the native urethral stump when applicable. A suprapubic and transurethral catheter was left in place postoperatively. The transurethral catheter was removed after 1 week to 10 days. Until then the patient stayed in bed. Voiding was started at day 12. The suprapubic catheter was removed once the patient was able to void without significant residual volume. The surgical technique has been described in detail elsewhere.⁶

For the implantation of a penile stiffener, the patient has to wait until the return of sensation to the top of the neophallus, which usually takes approximately 1 year. Four patients have already undergone this procedure. An AMS Ambicor penile prosthesis (American Medical Systems, Minnetonka, Minn) with two cylinders is implanted.

After phalloplasty the patients are re-evaluated by the same sexologist-psychiatrist. The same questionnaire was used regarding self-esteem and sexual well-being. Other questions were asked regarding their satisfaction after phalloplasty and whether they regretted undergoing the phalloplasty.

RESULTS

In all patients the graft survived. In the early postoperative period two major complications were seen: 1 patient developed a pulmonary embolism and was treated with a therapeutic dose of low-molecular-weight heparin. Another patient developed severe hematuria with clotting and obstruction of the urinary catheters. A lavage system of the bladder was used for several days to resolve this problem.

There were no complications concerning the donor area. Five of seven patients underwent urethral reconstruction. Four pass urine through the urethra; 1 only ejaculates. Two patients developed a fistula at the anastomosis of the neourethra to the native urethra. In 1 patient this fistula was accompanied by a urethral stricture. In both patients a secondary procedure was necessary with closure of the fistula. In the patient with the concomitant urethral stricture an end-to-end urethroplasty was performed. After these corrective procedures all 4 patients without appendicovesicostomy can void normally in a standing position.

All but 1 patient report sensitivity in the neophallus. Patient satisfaction after phalloplasty was high in 6 patients and moderate in 1 patient because of a hypertrophic scar at the neophallus. Psychological evaluation confirms these good results: all patients reported a boost in their self-esteem level. No patient regretted undergoing the phallic reconstruction. Some results are shown in Fig. 1.

Four patients underwent implantation of a penile stiffener. Unfortunately in 2 patients the erectile implant had to be removed because of infection. The other 2 patients report good sexual activity with orgasm, and 1 even ejaculates through the new penis.

COMMENT

Penile insufficiency and absence are devastating conditions with significant psychological and physical impact. Possible treatment options are gender reassignment, tailoring of the penile stump, penile replantation, phalloplasty, and most recently penile transplantation.



Figure 1. Appearance of the genital region before (upper line) and after (lower line) phalloplasty in some patients.

In the past, sex reassignment to the female gender has been offered on the basis of the principles applied to newborns with disorders of sexual development and ambiguous genitalia. There is no evidence to show that the outcome of this policy is satisfactory.¹⁰ Today sex reassignment is no longer considered the treatment of choice.

Tailoring of the penile stump by means of penile degloving, division of the suspensory ligament, and rotational skin flaps has been reported.^{4,5} However, this can only be applied to moderate penile injuries with a still reasonable penile stump. In our series the loss of functional tissue was so severe that it could not be applied.

Penile replantation can be attempted in the acute phase (less than 24 hours) of traumatic penile amputation. The survival of the replanted penis depends on the viability of the amputated segment and the condition of the penile stump. Current replantation techniques rely on meticulous microsurgical approximation of the dorsal structures and cavernosal arteries. Among 19 cases compiled from the literature in which erectile function was reported, 15 patients (79%) had normal erections after replantation. Sensation was preserved in 82% of patients.¹¹ In traumatic amputation, penile replantation is the primary treatment option.¹¹ This technique, however, was not indicated for our patients.

Recently one case report has been published on penile transplantation.¹² It is possible owing to microsurgical techniques and our knowledge in immunosuppressive medication. Unfortunately, the transplanted penis was cut off 14 days postoperatively because of psychological

problems of both the patient and his partner. This technique is still experimental and is not a current treatment option.

Phalloplasty is another treatment option. The first phallic reconstruction was described by Bogoras in 1936.¹³ Phalloplasty procedures have followed the advances made in plastic surgery. Originally it was a complex, time-consuming, multistage procedure with variable and suboptimal results.^{14,15} The development of microsurgical free-flap techniques was followed in phalloplasty, and in 1984 Chang completed the first successful microsurgical phalloplasty with a radial forearm free flap,¹⁴ which today is the gold standard in phalloplasty for female-to-male transsexuals.^{6,8} This technique can also be applied to males without a functional penis. Literature on phalloplasty for males without a functional penis is scarce, and to our knowledge this is one of the few series published. Perovic³ reported phalloplasty in 24 patients without a functional penis using the extended pedicle island groin flap. He suggests this technique as an alternative to the microsurgical free tissue phalloplasty. Djordjevic *et al.*¹⁵ reported the musculocutaneous latissimus dorsi free flap for total phalloplasty in 8 boys. As in our series, they also report a significant improvement in psychological status. They even recommend this surgery before puberty to ensure optimal psychosexual development.¹⁵ Sengezer *et al.*¹⁶ suggested total penile reconstruction with a sensate osteocutaneous free fibula flap. With this technique promising results were obtained in 18 patients. Gilbert *et al.*¹⁷ were the first to describe the

application of a radial free forearm flap for phallic reconstruction in 11 boys without a functional penis. Satisfactory results were obtained. At our institution we prefer the free radial forearm flap.

As in transsexuals, males undergoing this technique still suffer significant morbidity. In our series no complications were found concerning the flap or donor area. However, in another series,⁶ flap failure necessitating surgical reintervention of the vascular anastomosis was described in 19%.

Considering donor site morbidity, the use of a split-thickness graft from the thigh and the application of a pressure garment on the forearm for a 6-month period gives the scar of the forearm an acceptable aspect. Wound-healing problems at the recipient site are common, and in our series 1 patient complained of an unaesthetic, hypertrophic scar. Pulmonary embolism has been reported in 1 patient. The patients are at risk because of a long operation time and a long postoperative immobilization of 1 week to 10 days. Prevention is very important, with elastic stockings and subcutaneous injection of fractionated heparin starting the day before surgery.

The urinary tract complication rate is high: 2 patients developed a fistula, which was combined with a stricture at the anastomosis site in 1 patient. A secondary procedure was necessary in both patients. Urinary tract complications are frequent (up to 42%) and well-known from our experience with transsexual phalloplasty.⁶ It is important to inform the patient before reconstruction about these possible complications. A preoperative evaluation of the urinary tract with uroflowmetry and ultrasound is mandatory.

Regaining sexual function is one of the goals in phallic reconstruction. In all patients any sensitive penile tissue left was incorporated, and in 4 patients we could even use glandular tissue that was incorporated at the base of the phallus. This is important for sexual stimulation and pleasure. Erogenous and tactile sensation of the neophallus is obtained by microscopic anastomosis of, respectively, the dorsal penile nerve and the ilioinguinal nerve to the cutaneous nerves of the flap. Of the 6 patients who underwent radial forearm flap phalloplasty, 5 reported sensitivity in the neophallus. One patient has not yet, but he has only recently been operated and we probably have to wait for the definitive result. This is a good result and comparable to our results obtained in transsexuals.¹⁸

In 1 adolescent patient presenting with epithelioid sarcoma, the phalloplasty was performed in a one-stage procedure with the penectomy.¹⁹ This could be an option for some patients undergoing penile amputation if oncologically acceptable.

Obtaining sufficient rigidity of the penis to allow penetration is extremely difficult because there is no good substitute for the unique erectile tissue of the penis. The radial forearm flap is too soft and can even demonstrate an atrophy of the subcutaneous fat, with a loss of more

than 20% of circumference.²⁰ The use of bone or cartilage transplants has often resulted in complications and failure because of resorption, curving, or fracture.²¹ For sexual penetration a penile stiffener is needed, and fortunately the radial forearm flap has a sufficient subcutaneous bulk to permit incorporation of a penile prosthesis. Incorporation of a penile stiffener can only be performed after the phallus is endowed with sufficient protective sensation, which usually takes at least 12 months. Good protective sensation is critical to prevent breakdown and erosion of the stiffener.²² Implantation of a penile prosthesis must also be withheld until the urethra is stable and the patient is free of voiding symptoms.²² Four of our patients have already received a penile stiffener. Unfortunately, two stiffeners had to be explanted because of infection and perforation. In other series,^{6,22,23} high explantation rates (20% to 50%) are also reported. One of the reasons could be the less vascularized skin and subcutaneous tissue of the neophallus (in comparison with a native impotent penis), which can lead to chronic ischemia after implantation and subsequently diminished resistance against infection and perforation. The erectile devices currently used for impotent men are the only available devices. Their long-term function, however, is a major concern. Because impotent men are generally older and sexually less active than the phalloplasty population, the chance of malfunction over the long term of the hydraulic device is realistic.

Despite the above-mentioned complications, the satisfaction rate after phalloplasty is good in this series. None of our patients regrets the surgery. An important boost in the self-esteem level was observed in each patient, which is a very important outcome factor postoperatively.

Of course, more or larger series of patients undergoing phalloplasty in cases of penile insufficiency are needed to confirm these results.

CONCLUSIONS

The reported success of phalloplasty in cases of penile insufficiency has convinced us that phalloplasty is a valuable treatment option for this condition. It has good results on the self-esteem level and in terms of patients' physical and psychological well-being.

Full information about possible complications, such as fistulae and strictures, is important. The complication rate of the erectile implants is high, as in transsexual surgery.

This technique opens new horizons for the treatment of penile agenesis, micropenis, crippled penis, shrivelled penis, some disorders of sexual development, traumatic amputations in which the amputated segment is lost for replantation, iatrogenic amputations, and cloacal exstrophy.

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EDITORIAL COMMENT

Lumen *et al*. present a retrospective 2-year series of 7 patients with penile insufficiency who were reconstructed using free microvascular tissue phalloplasty. All patients had loss of functional penile tissue from surgery for bladder exstrophy or hypospadias, repeat placement of penile prosthesis, or amputation from trauma or cancer. Four of the patients underwent reconstruction for a congenital anomaly. Six of the patients were reconstructed with a

radial forearm free flap and 1 with an anterolateral thigh flap. Flap survival was 100%. All 7 patients had low self-esteem, which improved after penile reconstruction. Cosmetic results were excellent. The authors should be commended for their work with complex penile reconstruction in this challenging group of patients.

Microvascular phalloplasty has become the gold standard for total penile reconstruction. Having first described the use of the radial forearm free flap for penile reconstruction in 1984, Chang *et al*.¹ paved the way for more complex and sophisticated reconstruction. Modifications such as the coronal flap and full-thickness skin graft to imitate the glans of the penis and tattooing of the glans² have further refined the technique and improved the aesthetic results. The experience with sex reassignment surgery in female-to male-transsexual patients has demonstrated that meticulous nerve dissection and nerve coaptation of the ilioinguinal and dorsal nerves with the cutaneous nerves to the flap allows the reconstructed penis to obtain tactile and erogenous sensitivity.³ Incorporating remnant glandular tissue into the base of the reconstructed penis in congenital cases may provide similar results.

Although the aesthetic results of microsurgical phalloplasty have become quite satisfactory, the urethroplasty complication rate and dissatisfaction with the forearm donor site remains high. The authors report a urethral fistula complication rate of 40%, which is comparable to that seen in other series.² Most of the urethral problems can be corrected with secondary procedures. Use of the anterolateral thigh flap for microsurgical phalloplasty avoids many of the concerns about the forearm donor site. Despite these complications, patient satisfaction remains high after reconstruction.

Our team of plastic surgeons and urologists has had similar results using the radial forearm flap for penile reconstruction in patients with severe penile insufficiency secondary to bladder exstrophy. We have also used a small, tubed radial forearm free flap for urethral reconstruction alone in patients with inadequate soft tissue after multiple failed attempts at hypospadias correction.

In their small series of patients, the authors have demonstrated that improved aesthetics and return of sexual function after innervated microvascular free tissue phalloplasty make this technique a viable option for penile reconstruction in patients with penile insufficiency. Their excellent results with congenital cases are encouraging.

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